

said semiconductor right under said electrode pad to have a large resistivity and not have electric current pass therethrough.

R E M A R K S

Reconsideration and allowance in view of the foregoing amendments and the following remarks are respectfully requested. Currently, claims 1-21 are pending in this application. However, claims 15-19 have been withdrawn from consideration.

Rejection Under 35 U.S.C. § 103

Claims 1-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakamura et al (U.S. '422) in view of Manabe et al (U.S. '120) and Nakamura et al (U.S. '350). Applicant respectfully traverses this rejection.

In order to establish a *prima facie* case of obviousness, all of the claimed limitations must be taught or suggested by the prior art and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teaching.

Applicant respectfully submits that the combination of Nakamura et al (U.S. '422), Manabe et al and Nakamura et al (U.S. '350) fails to teach or suggest all of the claimed limitations. In particular, the combination fails to teach or suggest an **electrode pad** having a three layer structure, wherein the lowest layer (a first metal layer) is formed by a metal which has an ionization potential lower than gold, a middle layer (a second metal layer) is formed of gold, and an upper layer (a third metal layer) is formed of a material which has an adhesiveness to a protection film which is stronger than that of gold.

The Office Action states that Nakamura et al (U.S. '422) shows a bonding pad 17 which is composed of nickel (Ni) and gold (Au), but teaches against the use of aluminum (Al) in a two layer structure since it can migrate to the electrode and can degrade it.

Nakamura et al (U.S. '422) further teaches that the metallic materials of the bonding pad 17 exhibit good adhesion with the p-electrode 13 and a metallic ball formed from a bonding wire during the wire bonding (see column 7, lines 16-18). Figure 4 of Nakamura et al (U.S. '422) shows that a pad 32 may be formed of a plurality of layers which is adhered strongly to a p-layer 13 and a metallic ball. As suggested by the Office Action, while Nakamura et al (U.S. '422) shows a bonding pad being formed of two materials, Nakamura et al (U.S. '422) fails to teach or suggest the claimed three layer structure discussed above.

Nakamura et al (U.S. '350) discloses electrodes 17, 27 and 36 in Figures 1, 2 and 3, respectively. The electrodes can be formed by nickel (Ni) and gold (Au). Like Nakamura et al (U.S. '422), Nakamura et al (U.S. '350) does not teach or suggest an electrode pad with the three layer structure discussed above.

The Office Action states that "Manabe et al. show the use of Al in a multilayer electrode stack (see Figure 6 and column 5, line 38) which has improved operating characteristics." Applicant respectfully notes, however, that the electrode 70 in Figs. 6-7 of Manabe et al is an electrode layer, not an electrode pad as required by the claimed invention. Therefore, Manabe et al fails to resolve the above deficiencies of Nakamura et al (U.S. '422 and '350) with respect to an electrode pad having the claimed three layer structure. Since Manabe et al describes an electrode layer, not an electrode pad, one of ordinary skill in the art would clearly not have been motivated to modify the electrode pad of Nakamura et al (U.S. '422 and '350) to include an electrode pad with the claimed three layer structure from the teachings of Manabe et al. Moreover, including an Al layer as taught by Manabe et al into the structure of Nakamura et al (U.S. '422) would clearly contradict the teachings of Nakamura et al, which as indicated by the Office Action, teaches against the use of Al.

Accordingly, Applicant respectfully submits that claims 1-11 are not obvious over Nakamura et al (U.S. '422), Manabe et al and Nakamura et al (U.S. '350) and respectfully requests that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Rejection Under 35 U.S.C. § 102

Claims 12-14 were rejected under 35 U.S.C. § 102(b) as being anticipated by Nakamura et al (U.S. '422). Applicant respectfully traverses this rejection.

For a reference to anticipate a claim, each element of the claim must be found, either expressly or under principles of inherency, in the reference.

Applicant respectfully submits that Nakamura et al (U.S. '422) fails to disclose each element of the claimed invention. In particular, Nakamura et al (U.S. '422) fails to disclose the following claimed limitation:

... the portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that of said first electrode layer by heat treatment and provides a contact resistance between said electrode layer and said surface layer lower than said portion covered with said electrode pad.

The present invention is characterized by an electrode layer which is positioned underneath an electrode pad. The electrode layer has a larger resistivity under the electrode pad as compared to another portion where the pad does not exist. Because of the resistivity of this structure, electric current cannot pass through the p-type semiconductor right under the pad. Accordingly, electric current passes through only a portion which emitted light can pass through so as to improve the ratio of a luminous strength to a current intensity.

Nakamura et al (U.S. '422) fails to disclose, or even suggest the above claimed feature. Nakamura et al (U.S. '422) also fails to appreciate the benefits resulting therefrom. Thus, the above structure is not disclosed by, or inherent from, the teachings of Nakamura et al (U.S. '422). If the rejection of claims 12-14 is maintained, Applicant respectfully

requests that the next Office Action indicate what specifically teaches the above structure or renders the above structure inherent.

New Claims

New claims 20-21 were added to provide additional protection for what Applicant believes to be the invention. Since claims 20 and 21 depend from claims 6 and 12, respectively, Applicant believes that these claims are allowable for the same reasons noted above.

Conclusion

All objections and rejections having been addressed, Applicant believes that claims 1-14 and 20-21 in this application are in condition for allowance and respectfully requests a Notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

PILLSBURY MADISON & SUTRO LLP

By: 

Peter W. Gowdey
Registration No. 25,872
Tele: (202) 861-3078
Fax : (202) 822-0944

PWG/RYM:sac

1100 New York Avenue, N.W.
Ninth Floor, East Tower
Washington, D.C. 20005-3918
Telephone: (202) 861-3000

Accordingly, Applicant respectfully submits that claims 1-11 are not obvious over Nakamura et al (U.S. '422), Manabe et al and Nakamura et al (U.S. '350) and respectfully requests that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

Rejection Under 35 U.S.C. § 102

Claims 12-14 were rejected under 35 U.S.C. § 102(b) as being anticipated by Nakamura et al (U.S. '422). Applicant respectfully traverses this rejection.

For a reference to anticipate a claim, each element of the claim must be found, either expressly or under principles of inherency, in the reference.

Applicant respectfully submits that Nakamura et al (U.S. '422) fails to disclose each element of the claimed invention. In particular, Nakamura et al (U.S. '422) fails to disclose *the following claimed limitation*

... The portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that of said first electrode layer by heat treatment and provides a contact resistance between said electrode layer and said surface layer lower than said portion covered with said electrode pad.

The present invention is characterized by an electrode layer which is positioned underneath an electrode pad. The electrode layer has a larger resistivity under the electrode pad as compared to another portion where the pad does not exist. Because of the resistivity of this structure, electric current cannot pass through the p-type semiconductor right under the pad. Accordingly, electric current passes through only a portion which emitted light can pass through so as to improve the ratio of a luminous strength to a current intensity.

Nakamura et al (U.S. '422) fails to disclose, or even suggest the above claimed feature. Nakamura et al (U.S. '422) also fails to appreciate the benefits resulting therefrom. Thus, the above structure is not disclosed by, or inherent from, the teachings of Nakamura et al (U.S. '422). If the rejection of claims 12-14 is maintained, Applicant respectfully